HUMAN REPRODUCTION

- Humans → Sexual Repr. → Viviparous
- Repr. Events include:
  - Gameto-genesis → form of gametes (♂ → Sperm, ♀ → Ovum)
  - Insemination → Sperms transfer to Female genital tract
  - Fertilization → ♂ gam. + ♀ gam. fusion leading to form. of Zygote
  - Form. & development of blastocyst
  - Implantation → Blastocyst attachment to uterine wall.
  - Gestation → embryonic development
  - Parturition → Delivery of baby

Sperm Ovum — occur after puberty

Remarkable difference (not similarity) in reproductive events of

Male	Female
Sperm formation continues even in old men	Formation of ovum ceases in women around age of 50 yrs.

If a dog gave birth to 6 puppies, means it gave birth to 6 eggs

Monozygotic twins – identical – 1 egg

Dizygotic twins – non-identical (fraternal) – 2 eggs

MALE REPRODUCTIVE SYSTEM

* Located in : Pelvis region

4 parts

(1) Testes

- Situated: Outside abdominal cavity
- within pouch
- Scrotum
- helps in maintaining lower temp. (2°-2.5°C lower than normal body temp)
- necessary for SPERMATOGENESIS

- Shape – oval
- Length – 4-5 cm
- Width – 2-3 cm.
- Covering – Dense

TESTES has 250 compartments TESTICULAR LOBULES

Accessory ducts

Seminiferous tubules → leads to
- Rete-testis → leads to
- Vasa Efferentia (① leave testis ② open into)
- Epididymis (located along posterior surface of each testis) → leads to
- Vas deferens → ascends to Abdomen & loop over the urinary Bladder

Receives ducts from Seminal vesicle

(3) Accessory glands

- Seminal Vesicle (paired)
- Prostate gland (unpaired)
- Bulbourethral (paired) – secretions help in lubrication of the penis

from all 3 secretions from these glands constitute Seminal plasma

rich in ① Fructose ② Ca ③ Certain enzymes

(1) External genitalia

PENIS → made up of Special tissue → help in Erection of penis to facilitate Insemination

- Enlarged end of penis → Glans penis covered by Loose fold of skin called FORESKIN.

Each lobule
↓ has
1 - 3 highly coiled SEMINIFEROUS TUBULES
↓
sperms are produced

Each seminiferous tubule
↓ lined by
2 types of cells
- Male germ cells (SPERMATOGONIA)
  ↓ undergo
  Meiotic division
  ↓ leads to
  Sperm formation
- Sertoli cells
  ↓
  Provide nutrition to germ cell.

opens ↓ into
Urethra as ejaculatory duct.

* These ducts store & transport the sperms from testis to outside through urethra.

originates from urinary bladder
↓
extends through the penis
to ↓ its
External opening "Urethral Meatus"

Region outside semi tubule (INTERSTITIAL SPACE)
contain
- Small B.V
- INTERSTITIAL CELLS / LEYDIG CELLS
  synthesis & secrete
  ↓
  TESTICULAR HORMONE
  called
  ↓
  ANDROGENS

* Other immunologically competent cells are also present.

* → Ovulation, fertilization, pregnancy, birth & child care.

These parts of system along with mammary gland are integrated structurally & functionally * to support

FEMALE REPRODUCTIVE SYSTEM

consists

Ovaries

Paired
↓
Primary sex organ
↓ produce
- ♀ gam. - Ovum.
- Several steroid hormone
  Ovarian hormone

Location: On each side of lower abdomen

Length: 2-4 cm.

Ovary ← connected by ligaments → Pelvic wall & uterus

Covering: Thin epithelium
↓ encloses
Ovarian Stroma
2 zones
- Peripheral cortex
- Inner medulla

Female accessory Ducts (4)

Fallopian tube
- Oviducts
- 10 - 12 cm long
- Extends from ovary to the uterus

* Part closer to ovary
↳ Funnel shaped INFUNDIBULUM
Its edges
↓
Finger like projections
↓ called
FIMBRAE
↳ Helps in collection of ovum after ovulation

* Infundibulum
↓ leads to
Wider part AMPULLA
↓
Last part is ISTHMUS
Has narrow lumen & it joins the

Uterus
- single
- called womb
- Inverted pear
- Supported by → Ligaments attached to pelvic wall

wall
3 layer of tissue
- Perimetrium: external, thin membranous
- Myometrium: middle, thick smooth muscle layer. exhibits strong contraction during parturition
- Endometrium: inner glandular layer → lines uterine cavity → undergo cyclical changes during menstrual cycle

Uterus
open into through cervix ↓
Vagina
narrow

Cavity of cervix — cervical canal

Cervical canal + vagina → Birth canal

External Genitalia
↓ includes
- **mons pubis**
  Cushion of fatty tissue covered by → skin, → hair
- **labia major**
  Fleshy folds of tissue extends down from mons pubis & surround the vaginal opening
- **Labia minora**
  Paired folds of tissue under labia major
- **Hymen**
  Opening of vagina partially covered by this membrane.
- **Clitoris**
  tiny finger like above urethral opening at the upper junct. of labia

Mammary gland

- often formed, during 1st coitus (intercourse).

However it can be broken when → sudden fall or jolt → insertion of vaginal tampon → active participation in sports like horse back riding, cycling

In fact, in some woman hymen may persist even after coitus.

"Hymen — presence or absence – not a reliable indicator

MAMMARY GLANDS → paired

characteristic of All Female mammals

contains → Glandular tissue → Variable amt of fat

Focus

divided into

L Mammary lobes (15 – 20)

contains

A clusters of cells called alveoli → secrete → milk → stored in Cavities / lumen of alveoli

opens into

LATDAL

T Mammary tubules

(tubule from each lobe forms) imp

D Mammary duct

several of these join

A Mammary ampulla (wider part)

connected to

L Lactiferous duct

through which

Milk sucked out.

GAMETOGENESIS → Process of form. of ♀ & ♂ gamete.

MALES

begins at

1) In testes → immature male germ cells (spermatogonia) — At puberty

Spermatogenesis ← by sperms ← produce

2) multiply by mitotic division & ↑ in no°.
Each spermatogonium — diploid → 46 chr
"Some" spermatogonia called → Primary spermatocytes

undergo

3) Meiosis periodically → forms → 2, equal, haploid cells called
23 chr each ← have

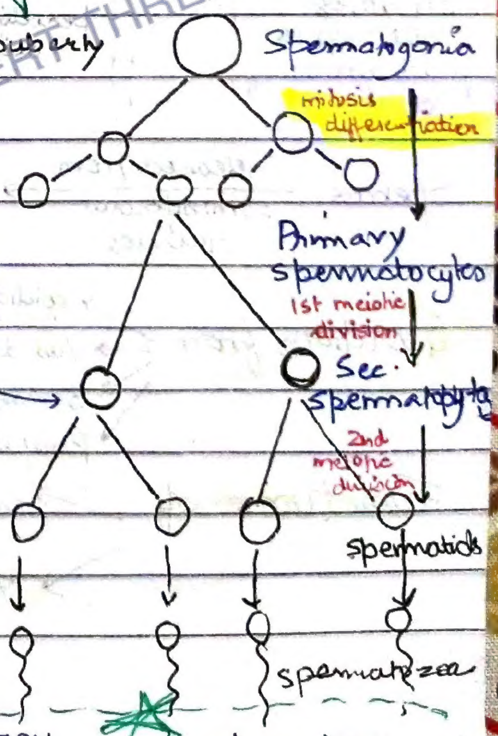
4) 4, equal, haploid - 23 chr

Spermiogenesis | transforms

5) 4, equal, n – Spermatozoa (Sperms)

after this → Sperm heads become embedded in sertoli cells

SPERMIATION → release from seminiferous tubules



Spermatogenesis → starts at → Age of puberty → due to → sig secretion of GnRH

stimulates ant. pituitary to secrete 2 gonadotropins

Luteinising Hormone (LH) → acts on → Leydig cells → stimulates synthesis & secretion of ANDROGENS → in turn stimulate → Spermatogenesis

(FSH) Follicle Stimulating hormone → acts on → Sertoli cells → stimulates → Secretion of some factors → help in → Spermiogenesis (spermatozoa)

-ve feedback: Inhibin ← gives ← Sertoli cells

Structure Of Sperm → microscopic

Plasma membrane envelops the whole body.

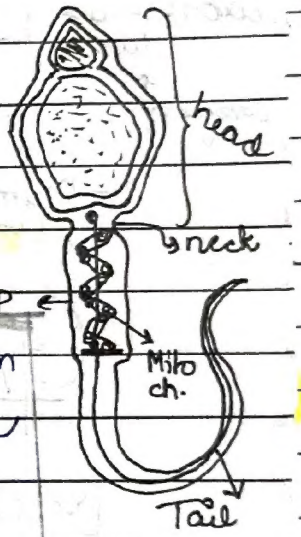
composed of

Head
- contains
  - Elongated haploid nucleus
  - ★ Head's ant. erior portion covered by → Cap like structure Acrosome filled with Enzymes that help in fertilisation of ovum.
    - Hyaluron① Idase
    - Acrosin②
    - CPE③

Neck
- Proximal centriole → helps in fertilization
- Distal centriole → form. of axial filament

Middle piece
- passes
- Numerous mitochondria (energy source for swimming) which produce
- Energy for movement of tail
- facilitate → Sperm motility essential for fertilization

Tail
- Long
- Whiplash movem.
- attained in epididymis



Human male ejaculates → 200 million sperms

For normal fertility

60% sperms must have normal (shape, size) → of which → 40% of them must show vigorous motility

Sperms → released from seminiferous tubules → are transported by accessory duct

Secretions from → epididymis, Vas deferens, Seminal vesicle, Prostate → essential for maturation & motility → along with sperms → constitute Semen

Functions of → male sex accessory ducts, Glands → maintained by → Androgens (hormones)

Date : / /
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FEMALE → Oogenesis

↗ process of form. of mature female gamete.

initiated during ↓ Embryonic Development stage

↓ with

A couple of million gamete mother cells (oogonia) are formed within each fetal ovary.

↓

* No more oogonia are formed and added after birth.

↓

These cells start division —enter into→ Prophase - I of meiotic division

then

Get arrested temporarily at → Primary Oocyte stage

Each primary oocyte —gets surrounded by→ Layer of Granulosa cells —called→ Primary follicle

☆ Large no. of these follicles —degenerate→ During the phase from birth to → puberty → only 60,000 - 80,000 primary follicles left in each ovary.

☆ (1) Primary follicles —get surrounded by ① more layers of granulosa cells & ② a new theca→ (2) Secondary follicles —transforms into→ (3) Tertiary follicles

Tertiary follicles —characterised by→
1) Fluid filled cavity called ANTRUM.
2) Theca layers org. into → theca interna (inner), → theca externa (outer)

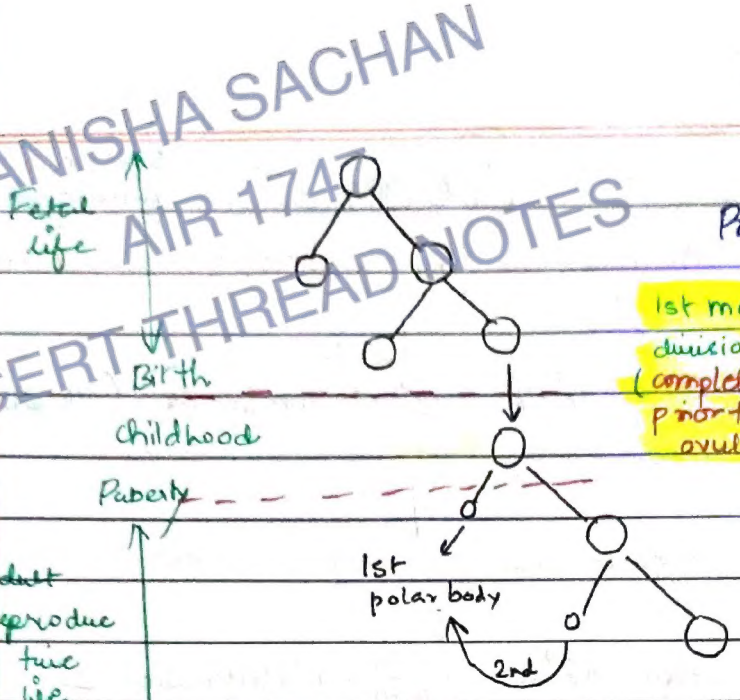
At this stage ↓ Primary oocyte → grows in size ↓ completes 1st meiotic division —results in→ (4) Formation of Secondary oocyte + Tiny 1st → Polar body → Fate of it is not known.

Secondary oocyte → retains bulk of nutrient rich cytoplasm of Primary oocyte

Tertiary follicles —further changes to→ (4) Graafian Follicle

Graafian Follicle → Sec. oocyte within this ↓ forms Zona pellucida

Graafian Follicle —ruptures, releasing (Ovulation)→ Sec. Oocyte OR OVUM



Menstrual Cycle

induced by changes in pituitary / ovarian hormones

Reproductive cycle in Female primates → monkeys, Apes, Human being

First menstruation begins at Puberty → called Menarche

In human female → repeat at an avg interval of 28/29 days

Events starting from one menstruation till menstruation one → called Menstrual cycle

One ovum released in Middle of each menstrual cycle.

Menstruation

- Duration : 3-5 days
- Menstrual flow occurs due to Breakdown of endometrial lining of uterus.
  - B.V present
  - forms liquid
  - Come out through vagina
- This phase occurs when ovum not fertilised but can also be occur due to stress, Poor health

Follicular phase (Proliferative phase)

Primary follicle grow to Fully matured Graafian follicle.

* endometrium regenerates through proliferation.

- These changes in ovary, uterus induced by changes in level of pituitary hormone, Ovarian hormone.
- Gonadotropins level ↑
  - LH, FSH
  - stimulates
    - Follicular development
    - Secretion of Estrogen by growing follicles

Ovulation (Ovulatory phase)

LH, FSH → attain peak at 14th day

LH surge induce ovulation

Implantation necessary for maintenance of endometrium & other events of pregnancy

Luteal phase (Secretory phase)

Remaining parts of Graafian follicle → changes to Corpus luteum → secretes Large amt of progesterone → essential for maintenance of endometrium

during pregnancy → All events of menstrual cycle stop & there is no menstruation

In absence of fertilization → C.L degenerate causes → Disintegration of endometrium

Menstruation ← leading to (marking a new cycle)

Menopause
↓
menstrual cycle ceases at → 50 yrs age. { Cyclic menstruation → indicator of normal reproductive phase
Monarche & menopause ← extends b/w

FERTILISATION & IMPLANTATION

During copulation (coitus) → Semen released by penis into vagina (insemination) → Motile sperm swim rapidly → pass through cervix → Reach uterus → finally reach Ampullary region of Fallopian tube

ovum should also be present here simultaneously. (main condition)

Fertilization occurs → process of → Fusion of sperm with an ovum.

During fertilz. → Sperm comes in contact with Zona pellucida → induces → Changes in membrane which → Blocks the entry of additional sperms → thus → Ensures only one ovum fertilized by only one sperm

* Secretion of acrosome
↓ help the sperm
To enter cytoplasm of ovum
| through
① Zona pellucida ② Plasma membrane

this induces → Completion of meiotic division of sec. oocyte
↓
Second meiotic division of oocyte is unequal → results in → (n) ovum / ootid and IInd polar body

sperm + ova
↓
Zygote.

* Father determines the sex of child, not mother.

* Mitotic division starts as → Zygote moves through isthmus of oviduct. called → Cleavage → towards uterus → forms → 2, 4, 8, 16 daughter cells called → Blastomeres

* Embryo with → 8 to 16 blastomeres is called → MORULA → continues to divide & transforms to → BLASTOCYST → as it moves further to uterus.

* Blastocyst ke andar → (Blastomeres) arranged in → Trophoblast → outer layer; Inner cell mass → inner grp of cells (attached to trophoblast)

Trophoblast layer —attaches to→ Endometrium ——→ Inner cell is differentiated as Embryo

↓ after attachment

Uterine cell divide rapidly

↓ covers the

Blastocyst —becomes→ Embedded in endometrium

↓

Implantation

PREGNANCY & Embryonic Development

After implantation ——→ finger like projection appear on trophoblast —called→ Chorionic Villi

Chorionic Villi surrounded by → Uterine tissue, Maternal blood

becomes inter digited with each other → jointly forms → Structural unit, Functional unit

b/w Foetus, Maternal body → called → PLACENTA

PLACENTA facilitates:
- supply of O_2, nutrients → to embryo
- Removal of CO_2, excretory/waste materials → from embryo

Through umbilical cord → Embryo; help in transporting of subst. to & from the embryo.

(UA + UV: oxyg. blood, deoxyg. blood)

Placenta → hCG, hPL, Estrogen, Progesterone, Relaxin

- hCG → Human chorionic Gonadotropin
- hPL → Human placental Lactogen
- Estrogen
- Progesterone
- Relaxin — secreted in Later phase of pregnancy — by ovary, not placenta

secreted in women only during pregnancy

Other hormones that increase several fold in maternal blood:

Estrogen, Progesterone, Cortisol, Thyroxine, Prolactin

support → Fetal growth, Metabolic changes in mother, Maintenance of pregnancy

Immediately after implantation ——→ inner cell mass (Embryo) differentiates

↓ into

Ectoderm → Outer layer; Mesoderm → Soon appears in b/w; Endoderm → Inner layer

these 3 give rise to → All tissue & organs

Inner cell mass

↓ has

Stem cells

↓

which have potency to give rise to

↓

All tissue & organs

Human pregnancy Lasts → 9 months

Dogs → 58 days · Elephants → 22 months

Cats → 58 of days

* After 1 month → embryo heart formed
  * First sign of growth → by listening to heart sound by stethoscope.

* 2 month → limbs, digits → develops

* 3 month (1st trimester) (End) (12 weeks) → Most major organs formed
  - limbs
  - External genitalia well developed

* 5th month → First movement of foetus
  → Appearence of head hair

* End of 2nd trimester (24 weeks) →
  - Body covered with fine hairs
  - Eye lids seperate
  - Eyelashes formed

PARTURITION & LACTATION

Vigorous contraction of uterus — causes → expulsion / delivery of baby.

Parturition → delivery of foetus.

- induced by → complex Neuroendocrine Mechanism
- its signal originate from → fully developed foetus, placenta → induce mild uterine contraction

Foetal Ejection Reflex ← called

triggers the release of

Oxytocin (from maternal pituitary)

acts on Uterine muscle & cause stronger contraction

Stimulates reflex b/w uterus and oxytocin secretion

continues resulting in Stronger contraction

leads to → Expulsion of baby through birth canal.

* Placenta, is also expelled, soon after.

Mammary Glands —undergo→ ★differentiation★ during pregnancy

- starts producing → milk (towards end of pregnancy)
- this process → Lactation
  - helps → mother in feeding the baby
  - Milk produced during initial days of lactation → Colostrum
    - contains several antibodies
    - absolutely essential for → To develop resistance for new born babies

Breast feeding —during→ initial period of infant growth
→ recommended by doctors
→ for healthy baby.

* Ovarian follicles in different stages of development
↓
embedded in stroma

* Male external Genitalia —called→ penis

* Fertilization → ampullary-isthmic junction